Sclerotinia Stem Rot Control in Small-seeded Lentil Production in the Black Soil Zone

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Abstract

Lentil production in the black soil zone is limited by the susceptibility of the crop to diseases such as sclerotinia stem rot. The objective of this project was to determine stem rot control strategies in small-seeded lentil by examining the impact of plant density, cultivar, fungicide treatment and timing of application on stem rot severity and yield. The relationship between flower petal infection and stem rot severity was also examined. Randomized complete block field experiments of three replicates were established at Rosthern and Melfort, SK and assessed for flower petal infection, disease severity and yield in 2000. Results of this single year of data indicated that fungicides reduced stem rot severity at both locations but increased yield only at Melfort, where later timing of application resulted in greater yield than early. Stem rot severity varied with cultivar however the cultivar with the greatest severity also had the greatest yield. Plant density had no effect on stem rot severity, but the lower plant density resulted in lower yield than the higher plant density. Flower petal infection was positively correlated with final disease rating only at Rosthern.

Introduction

High yield potential of lentil in the black soil zone has prompted breeding for adapted cultivars, in particular for small red and green types. Higher precipitation in this zone, however, promotes the development of sclerotinia stem rot. This disease, caused by the fungal pathogen *Sclerotinia sclerotiorum*, has been a serious problem in lentil production when late season precipitation occurs. Resistance to the pathogen is not available and recommendations on efficient disease management are not available in this crop. Effective stem rot control strategies have not been documented for this crop. The objective of this project was to determine such strategies in small-seeded lentil by examining the impact of plant density, cultivar, fungicide treatment and timing of application on disease severity and yield and to determine the relationship between petal infection and stem rot severity.

Material and Methods

Two experiments were initiated in early May, one at Rosthern under rainfed conditions and one at Melfort where mist irrigation was applied during flowering. Factorial randomized complete block experiments of 3 replicates included treatments of: three cultivars (‘Milestone’, ‘Robin’ and ‘Crimson’); two fungicides (benomyl - Benlate and iprodione - Rovral Flo) applied at 2 timings (early and late flower and an untreated control); and two plant densities (narrow row spacing at 8” or 9” with 100 plants m^{-2}, and wide row spacing at 16” or 18” with 50 plants m^{-2}).

Rovral Flo (720 g.ai. ha^{-1}) and Benlate (500 g.ai. ha^{-1}) were applied at 25 % bloom or 60 % bloom stage. Stem rot severity was assessed approximately 2 weeks before harvest by randomly selecting 10 plants/plot and scoring each on a scale from 0 (no symptoms) to 5 (main stem lesions affecting entire plant).

Petal tests were conducted on flowers from the untreated control plots with the 100 plants m^{-2}. Twelve flowers were randomly picked from each of these plots. One petal of each flower was removed and plated (4 petals per Petri dish) on potato dextrose agar (PDA) amended with streptomycin (0.1g/l PDA). Plots were sampled 6 times at Rosthern and 4 times at Melfort. Four to 5 days after transferring onto plates, Petri dishes were evaluated by counting the number of petals with colonies of sclerotinia mycelium.

Results and Discussion

At both locations, some of the fungicide treatments significantly reduced stem rot severity in comparison to the unsprayed control plots (Figure 1). Disease severity was higher at Melfort than at Rosthern, possibly due to misting during flowering and higher precipitation during the summer. Among the three cultivars, 'CDC Robin' had the lowest stem rot severity, followed by 'CDC Milestone' and 'Crimson'. On average, Benlate performed better than Rovral Flo did, but the optimal timing of the application varied with location. At Rosthern, performance of fungicides also appeared to be dependent on the cultivar, but generally late application of either fungicide was more effective than early. At Melfort, early application of Benlate performed best across all cultivars, followed by early application of Rovral Flo.

Plant density had no significant effect on disease development at either location (Figure 2), but lower plant density resulted in reduced yield. At Rosthern, yield of wide rows (50 plants m^{-2}) was on average 20% less than yield of narrow rows (100 plants m^{-2}), while at Melfort, under higher disease pressure, the difference in yield was at approximately 10%. These results show that lentil has a considerable ability to compensate for lower plant density.

Although some fungicide treatments reduced disease in both experiments, a significant yield increase in comparison to the unsprayed control was observed only at Melfort (Figure 3). Generally, late fungicide application resulted in higher yield compared to early fungicide application, but cultivar had a significant influence. Among cultivars, 'CDC Robin' had the lowest yield, while 'Crimson' performed best, in spite of having the greatest stem rot severity. Crimson produces a smaller canopy compared to the other cultivars, suggesting that specific cultivars may be more productive under conditions that favor stem rot development.

Similar to field disease ratings, flower petals at Melfort had higher disease levels than those from Rosthern. At Rosthern, it was demonstrated that the infection rate in flower petals was positively correlated to the final disease levels in the field (data not presented). At Melfort, this relationship was not observed.

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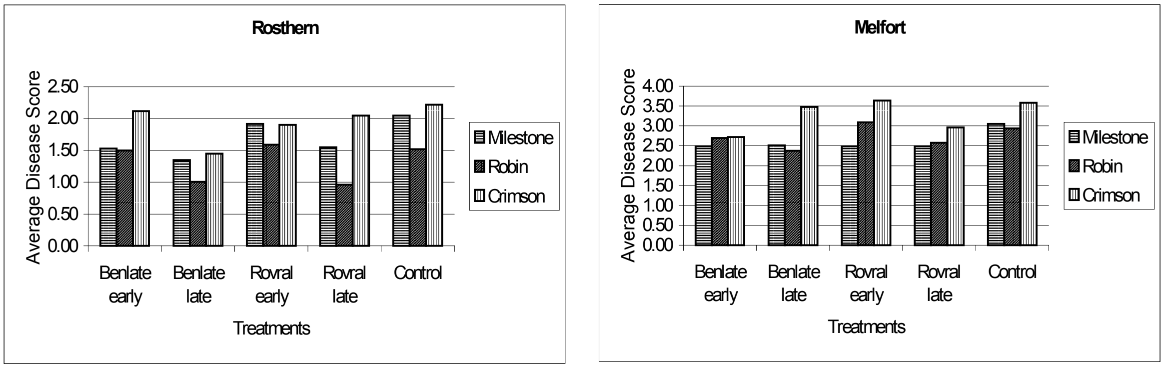

Figure 1: Control of *Sclerotinia sclerotiorum* in small-seeded lentil cultivars ‘‘Milestone’’, ‘‘Robin’’ and ‘‘Crimson’’ in plots with 2 different plant densities (8”/9” rows with 100 plants m^{-2} and 16”/18” rows with 50 plantsm^{-2}). through application of Benlate and Rovral Flo, respectively. Early sprays were applied at the 25 % bloom stage, late sprays were applied at 60 % bloom stage.

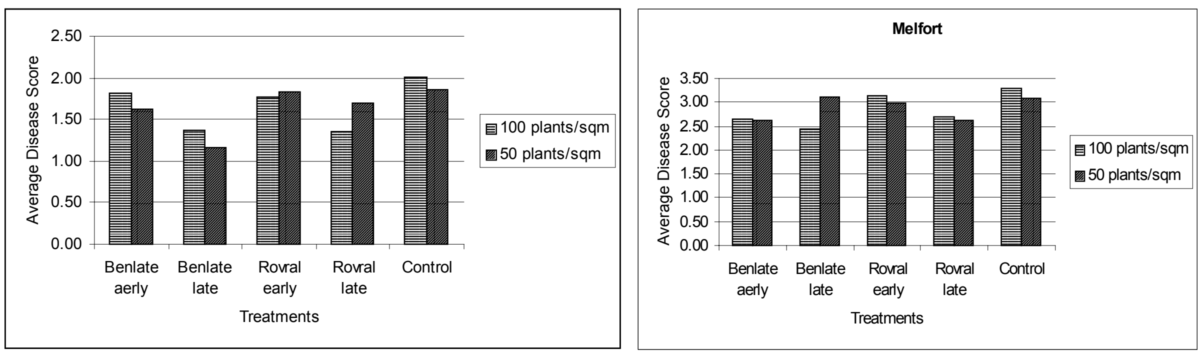

Figure 2: Control of *Sclerotinia sclerotiorum* in three lentil cultivars (‘‘Milestone’’, ‘‘Robin’’ and ‘‘Crimson’’) through application of Benlate and Rovral Flo, respectively, in plots with 2 different plant densities (8”/9” rows with 100 plants m^{-2} and 16”/18” rows with 50 plantsm^{-2}). Early sprays were applied at the 25 % bloom stage, late sprays were applied at 60 % bloom stage.

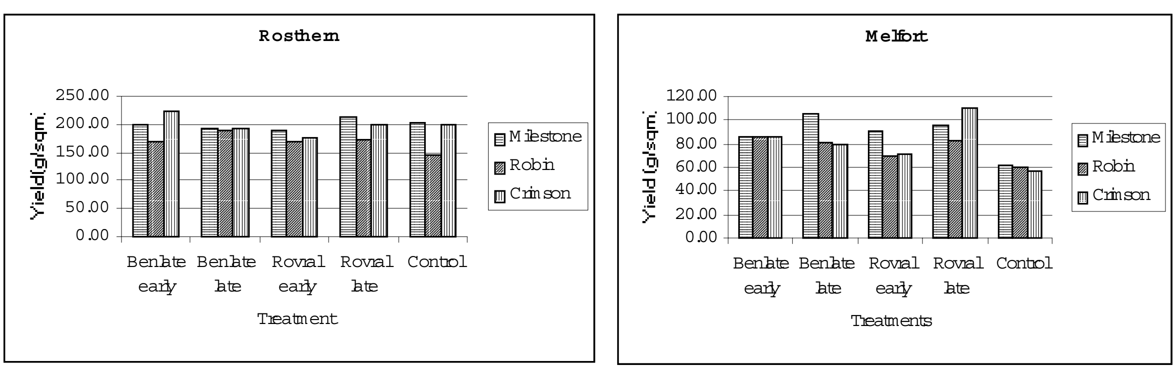

Figure 3: Yield in three lentil cultivars (‘‘Milestone’’, ‘‘Robin’’ and ‘‘Crimson’’) planted at 2 different plant densities (8”/9” rows with 100 plants m^{-2} and 16’/18’ rows with 50 plants m^{-2}) and treated with different fungicides (Rovral Flo early and late application, Benlate early and late application, control) for the control of *Sclerotinia sclerotiorum*. Fungicide treatments did not have any effect on yield.